

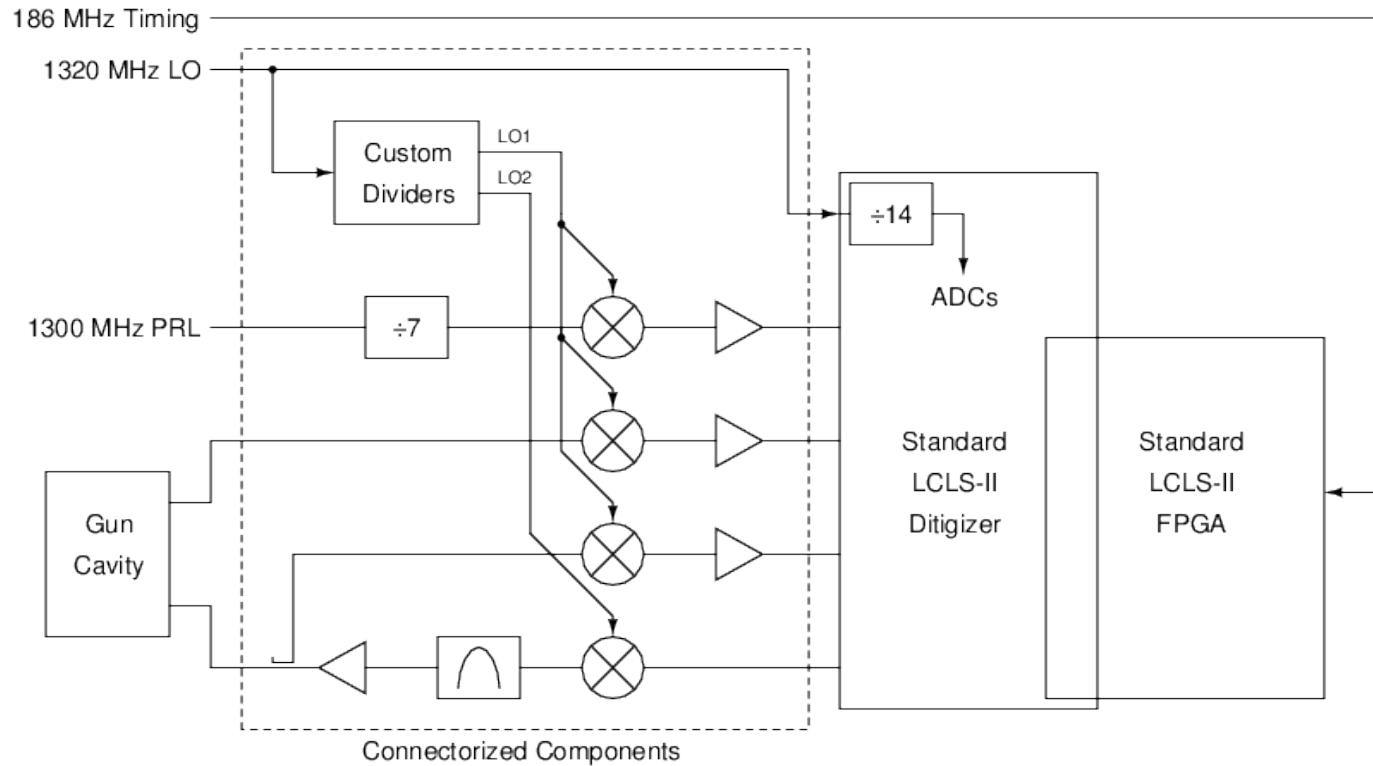
# **Gun and Bunker LLRF**

# Physics Requirement

Parameters	Jitter
Laser phase	100fs
Gun phase	0.01deg
Gun amplitude	0.005%
Buncher phase	0.01deg
Buncher amplitude	0.01%
1st cavity phase	0.01deg
1st cavity amplitude	0.01%
4th cavity phase	0.01deg
4th cavity amplitude	0.01%

# Concept

LCLS-II VHF Gun LLRF Concept



Possible LO/IF choices:

$$\text{LO1} = 1320 \text{ MHz} / 8 = 165 \text{ MHz}, \text{ IF} = 20.7 \text{ MHz} = 29/132 * \text{clk}$$

$$\text{LO2} = 1320 \text{ MHz} / 6 = 220 \text{ MHz}, \text{ IF} = 34.3 \text{ MHz} = 4/11 * \text{clk}$$

Larry 2016.4

# Frequencies

Gun

RF 185.7 MHz

LO 1320 MHz

$$\text{ADCCLK} = \text{LO}/14 = 94.3 \text{ MHz}$$

$$\text{DACCLK} = \text{LO}/7 = 188.6 \text{ MHz}$$

$$\text{LOdw} \text{ LO}/8 = 165 \text{ MHz}$$

$$\text{IFdw} = \text{RF} - \text{LOdw} = 20.7 \text{ MHz}$$

$$= 29/132 * \text{LO}/14$$

$$\text{LOup} = \text{LO}/6 = 220 \text{ MHz}$$

$$\text{IFup} = \text{LOup} - \text{RF} = 34.3 \text{ MHz}$$

$$= 4/11 * \text{LO}/14$$

Buncher

RF 1300.0

LO 1320MHz

$$\text{ADCCLK} = \text{LO}/14 = 94.3 \text{ MHz}$$

$$\text{DACCLK} = \text{LO}/7 = 188.6 \text{ MHz}$$

$$\text{IFdw} = \text{LO} - \text{RF} = 20 \text{ MHz}$$

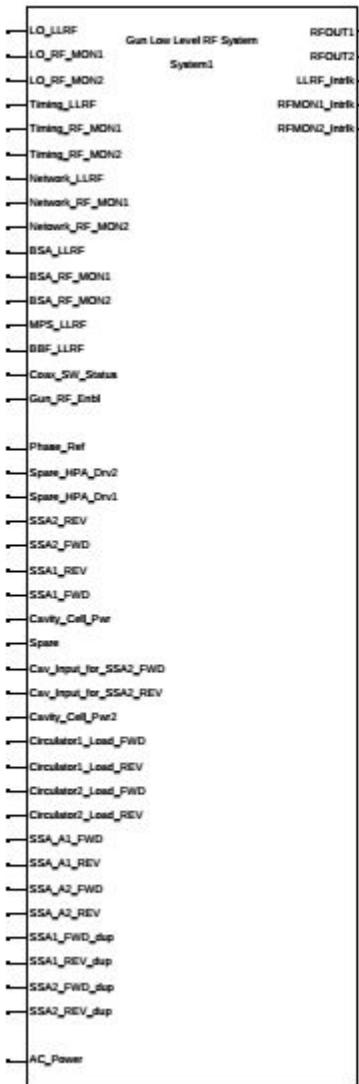
$$= 7/33 * \text{LO}/14$$

$$\text{LOup} = \text{LO} - \text{LO}/8 = 1155 \text{ MHz}$$

$$\text{IFup} = 145 \text{ MHz}$$

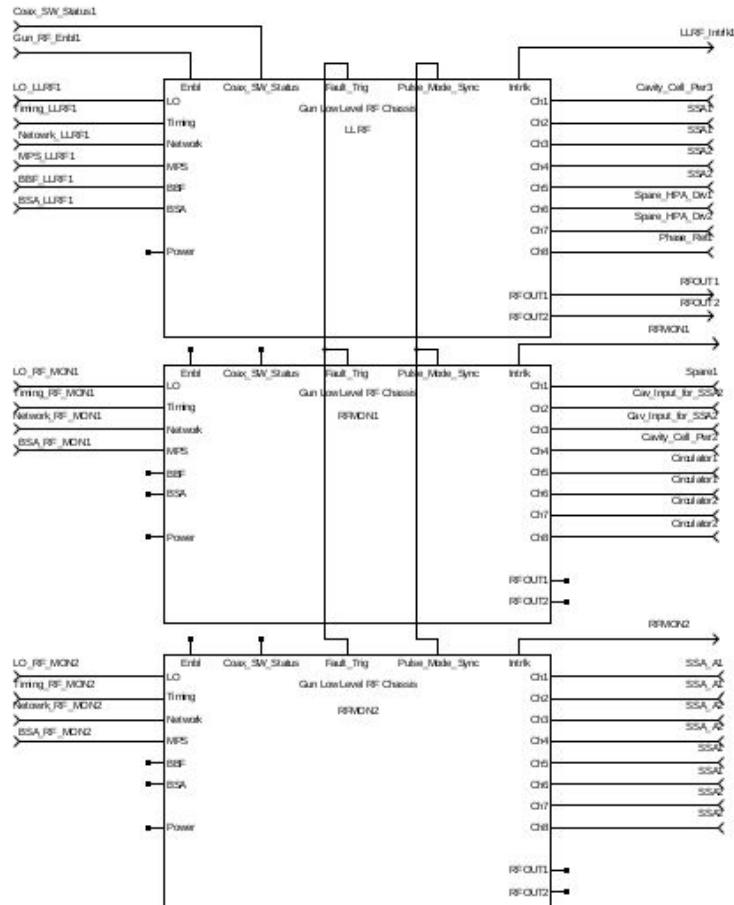
$$= 203/132 * \text{LO}/14$$

# Gun LLRF signals

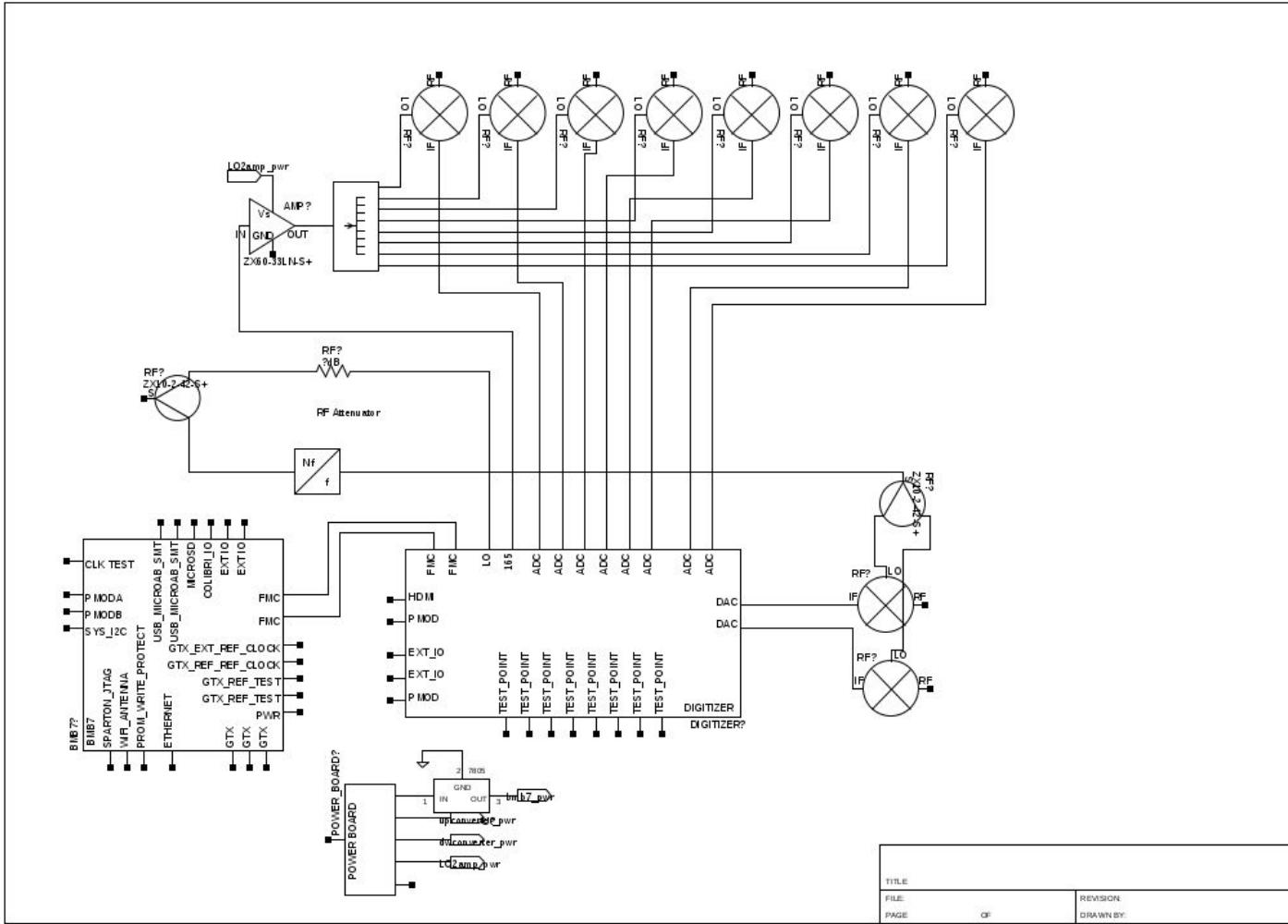


Signal name	Direction	signal type	Frequency	Power	Level (dBm)	Location
LO_LLRF	I	RF	1320	10	SLAC	
LO_RF_MON1	I	RF	1320	10	SLAC	
LO_RF_MON2	I	RF	1320	10	SLAC	
Timing_LLRF	I	Fiber			SLAC	
Timing_RF_MON1	I	Fiber			SLAC	
Timing_RF_MON2	I	Fiber			SLAC	
Network_LLRF	IO	Fiber			SLAC	
Network_RF_MON1	IO	Fiber			SLAC	
Netwrk_RF_MON2	IO	Fiber			SLAC	
BSA_LLRF	IO	Fiber			SLAC	
BSA_RF_MON1	IO	Fiber			SLAC	
BSA_RF_MON2	IO	Fiber			SLAC	
MPS_LLRF	I	Fiber			SLAC	
BBF_LLRF	I	Fiber			SLAC	
Coax_SW_Status	I	DC			LBNL GUI	
Gun_RF_Enbl	I	DC			LBNL GUI	
Phase_Ref	I	RF	1300	10	SLAC	
Spare_HPA_Drv2	I	RF	185.7	10	LBNL GUI	
Spare_HPA_Drv1	I	RF	185.7	10	LBNL GUI	
SSA2_REV	I	RF	185.7	10	LBNL GUI	
SSA2_FWD	I	RF	185.7	10	LBNL GUI	
SSA1_REV	I	RF	185.7	10	LBNL GUI	
SSA1_FWD	I	RF	185.7	10	LBNL GUI	
Cavity_Cell_Pwr	I	RF	185.7	10	LBNL GUI	
Spare	I	RF	185.7	10	LBNL GUI	
Cav_Input_for_SSA2_FWD	I	RF	185.7	10	LBNL GUI	
Cav_Input_for_SSA2_REV	I	RF	185.7	10	LBNL GUI	
Cavity_Cell_Pwr2	I	RF	185.7	10	LBNL GUI	
Circulator1_Load_FWD	I	RF	185.7	10	LBNL GUI	
Circulator1_Load_REV	I	RF	185.7	10	LBNL GUI	
Circulator2_Load_FWD	I	RF	185.7	10	LBNL GUI	
Circulator2_Load_REV	I	RF	185.7	10	LBNL GUI	
SSA_A1_FWD	I	RF	185.7	10	LBNL GUI	
SSA_A1_REV	I	RF	185.7	10	LBNL GUI	
SSA_A2_FWD	I	RF	185.7	10	LBNL GUI	
SSA_A2_REV	I	RF	185.7	10	LBNL GUI	
SSA1_FWD_dup	I	RF	185.7	10	LBNL GUI	
SSA1_REV_dup	I	RF	185.7	10	LBNL GUI	
SSA2_FWD_dup	I	RF	185.7	10	LBNL GUI	
SSA2_REV_dup	I	RF	185.7	10	LBNL GUI	
RFOUT1	O	RF	185.7	10	LBNL GUI	
RFOUT2	O	RF	185.7	10	LBNL GUI	
LLRF_Intrlk	O	RF	185.7	10	LBNL GUI	
RFMON1_Intrlk	O	RF	185.7	10	LBNL GUI	
RFMON2_Intrlk	O	RF	185.7	10	LBNL GUI	
Power	I	AC			SLAC	

# Gun LLRF



# Gun LLRF Chassis



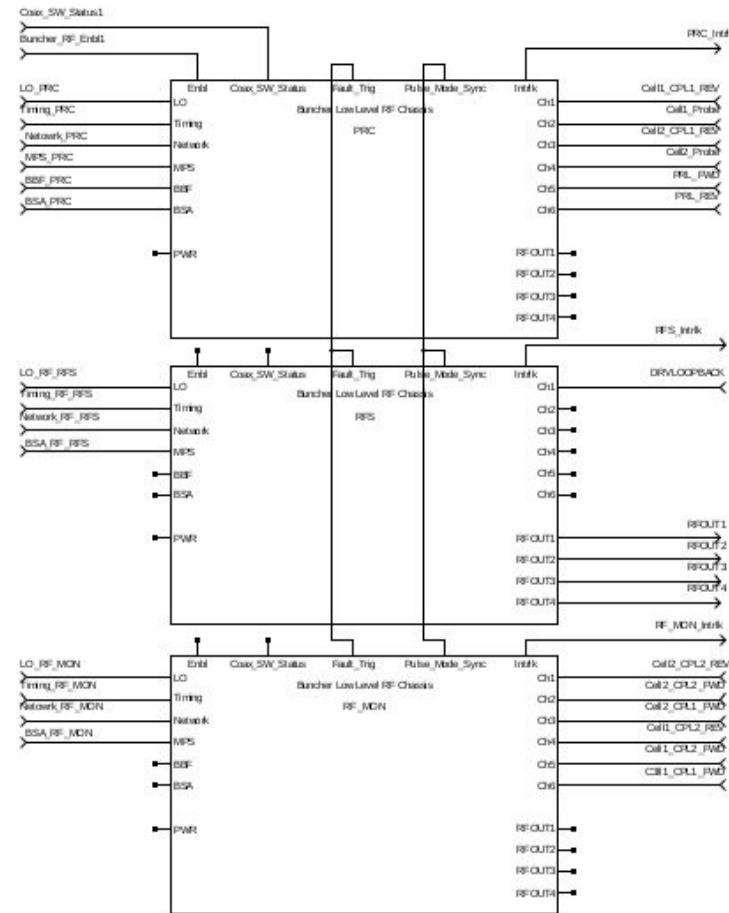
# Buncher LLRF signals

Signal name      Direction    signal type Frequency(Power Level (dBm)

LO_PRC	I	RF	1320	10	SLAC
LO_RF_RFS	I	RF	1320	10	SLAC
LO_RF_MON	I	RF	1320	10	SLAC
Timing_PRC	I	Fiber			SLAC
Timing_RF_RFS	I	Fiber			SLAC
Timing_RF_MON	I	Fiber			SLAC
Netowrk_PRC	IO	Fiber			SLAC
Network_RF_RFS	IO	Fiber			SLAC
Netowrk_RF_MON	IO	Fiber			SLAC
BSA_PRC	IO	Fiber			SLAC
BSA_RF_RFS	IO	Fiber			SLAC
BSA_RF_MON	IO	Fiber			SLAC
MPS_PRC	I	Fiber			SLAC
BBF_PRC	I	Fiber			SLAC
Buncher_RF_Enbl1	I	DC			LBNL GUI
Coax_SW_Status1	I	DC			LBNL GUI
Cell1_CPL1_REV	I	RF	1300	10	LBNL GUI
Cell1_Probe	I	RF	1300	10	LBNL GUI
Cell2_CPL1_REV	I	RF	1300	10	LBNL GUI
Cell2_Probe	I	RF	1300	10	LBNL GUI
PRL_REV	I	RF	1300	10	SLAC
PRL_FWD	I	RF	1300	10	SLAC
DRVLOOPBACK	I	RF	1300	10	LBNL GUI
Cell2_CPL2_REV	I	RF	1300	10	LBNL GUI
Cell2_CPL2_FWD	I	RF	1300	10	LBNL GUI
Cell2_CPL1_FWD	I	RF	1300	10	LBNL GUI
Cell1_CPL2_REV	I	RF	1300	10	LBNL GUI
Cell1_CPL2_FWD	I	RF	1300	10	LBNL GUI
C3ll1_CPL1_FWD	I	RF	1300	10	LBNL GUI
AC_Power	I	RF	1300	10	LBNL GUI
RFOUT1	O	RF	1300	10	LBNL GUI
RFOUT2	O	RF	1300	10	LBNL GUI
RFOUT3	O	RF	1300	10	LBNL GUI
RFOUT4	O	RF	1300	10	LBNL GUI
PRC_Intrlk	O	RF	1300	10	LBNL GUI
RFS_Intrlk	O	RF	1300	10	LBNL GUI
RF_MON_Intrlk	O	RF	1300	10	LBNL GUI

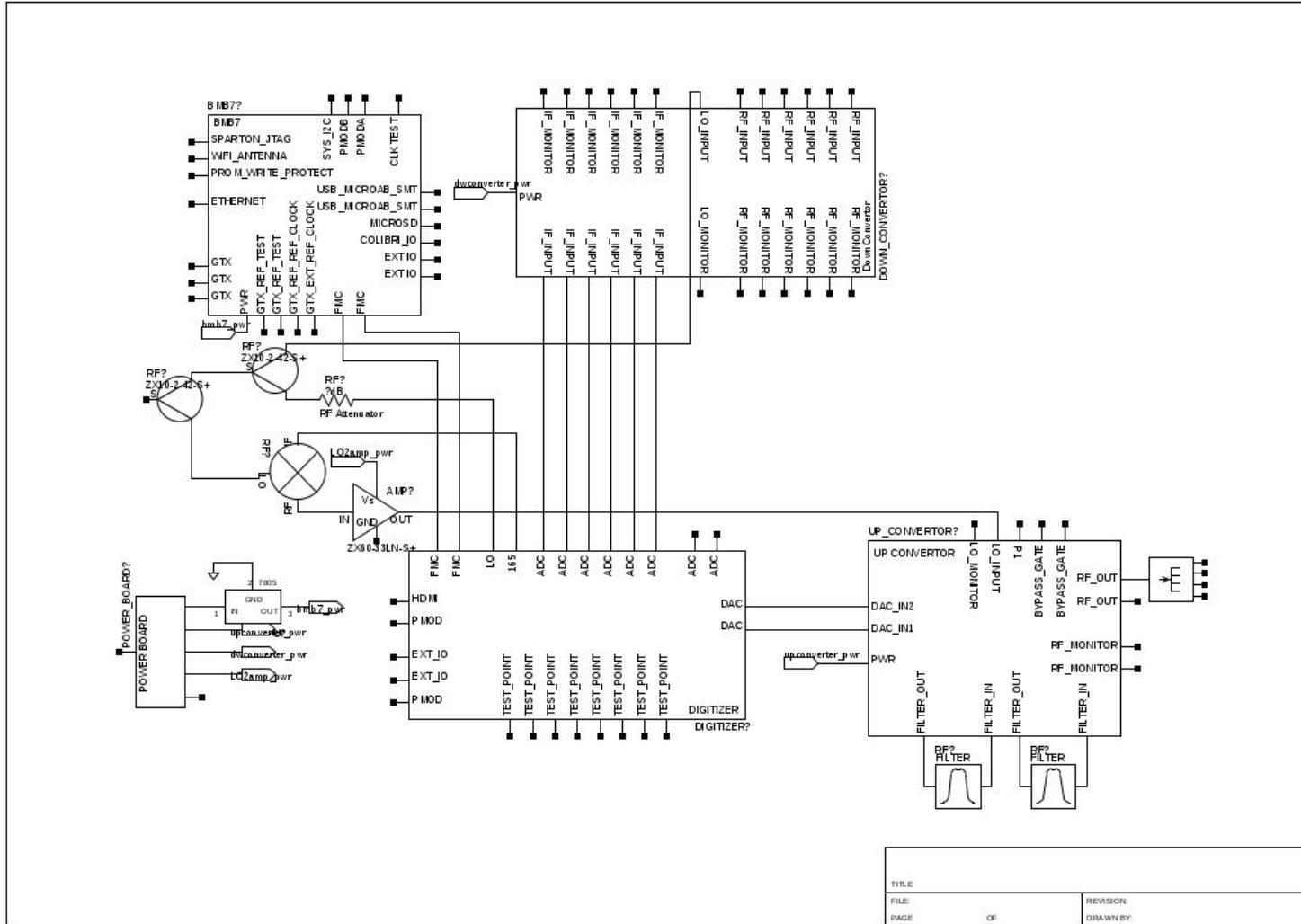


# Buncher LLRF



TITLE			
FILE:		REVIEWED:	
PAGE:	EF	BY:	

# Buncher LLRF Chassis (similar to LLRF)



# Schedule

- Mid-late July 2016: Gun and buncher LLRF concept peer review
  1. Confirm parameter by physical requirement document.
  2. Define system interface.
- July-Sept 2016: Design and build prototype
  - Preliminary design review?
- Oct-Dec 2016: Test on APEX
- Jan 2017: Final design review